

REMARKS

In the outstanding Office Action, claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Publication No. US 2004/0106292 to Sato et al. ("Sato") in view of Applicant's admitted prior art ("AAPA"); claims 2-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato in view of AAPA and further in view of U.S. Patent No. 6,596,607 to Ahn ("Ahn"); and rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Sato, in view of AAPA, and further in view of U.S. Patent No. 6,191,002 to Koyanagi ("Koyanagi"). The rejection was made final. Claims 1-5 remain pending in this application.

I. Request for the Withdrawal of the Finality of the Office Action

Initially, Applicants respectfully request withdrawal of the finality of the pending rejection since the Examiner failed to rebut or answer all of Applicants' arguments presented in Applicants' previous Response, filed January 3, 2005.

As stated in M.P.E.P. § 706.07, "where a single previous Office action contains a complete statement of a ground of rejection, the final rejection may refer to such a statement and also *should include a rebuttal of any arguments raised in the applicant's reply*" (emphasis added). Applicants submit that the Examiner failed to answer or rebut all arguments presented in the Response filed January 3, 2005, and has thus improperly made the rejection final. Specifically, the Examiner failed to answer or rebut Applicants' arguments directed to the lack of motivation for combining the references. Moreover, the Examiner failed to answer or rebut Applicants' arguments directed to the technical mistakes or misunderstandings of Sato, as presented at page 5 in the Response filed January 3, 2005.

Additionally, M.P.E.P § 707.07 (f) states: “[w]here the applicant traverses any rejection, *the examiner should, if he or she repeats the rejection, take note of the applicant’s argument and answer the substance of it*” (emphasis added). Here, the Examiner has repeated the same rejection of claim 1 as being unpatentable over Sato in view of AAPA, without addressing Applicants’ arguments which explained how AAPA is different from the present invention in at least the order of the steps of “heating said silicon oxide left in said device isolation trench to remove impurities” and removing said film of the silicon oxide leaving a residue inside said device isolation trench,” as recited in claim 1, and how, because of this difference, one of ordinary skill in the art would not have been motivated to combine the references in the manner suggested by the Examiner.

Thus, since the Examiner has improperly failed to rebut or answer all of Applicant’s arguments, Applicant respectfully requests that the finality of the pending rejection be withdrawn.

II. Rejections under 35 U.S.C. § 103(a)

Regarding the rejection of claim 1 under 35 U.S.C. § 103(a), Applicants respectfully disagree with the Examiner’s assertions and conclusions as set forth in the Office Action¹. Accordingly, Applicants respectfully traverse these rejections on the grounds that the Examiner has failed to establish a *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness under 35 U.S.C. §103(a), each of three requirements must be met. First, the reference or references, taken alone or

¹ The Office Action contains a number of statements reflecting characterizations of the related art and the claims. Regardless of whether any such statement is identified herein, Applicants decline to automatically subscribe to any statement of characterization in the Office Action.

combined, must teach or suggest each and every element recited in the claims. See M.P.E.P. §2143.03 (8th ed., 2001). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must “be found in the prior art, and not be based on applicant’s disclosure.” See M.P.E.P. § 2143 (8th ed., 2001). At a minimum, the Examiner cannot establish that the references teach each and every element of the claims and that there is motivation for combining the references in the manner the Examiner is suggesting.

A. Sato in view of AAPA

Claim 1 recites a combination including, *inter alia*, “heating said silicon oxide left in said device isolation trench to remove impurities for densification.” Sato, whether taken alone or in combination, fails to teach or suggest at least this element.

The Examiner states that at lines 8-12 of paragraph [0056], Sato teaches “heating (thermal processing) said silicon oxide left in said device isolation trench for densification, which *inherently* removes impurities.” Office Action, page 3 (emphasis added). The cited portion of Sato reads as follows:

thermal processing at 800[°]C is performed on the semiconductor substrate 1 for about one minute in a nitrogen gas atmosphere, for example. As a result, the film quality of the coating film 6c can be improved.

Sato, paragraph [0056].

The cited portion however, is silent to “remov[ing] impurities for densification,” as recited in claim 1. Moreover, the Examiner has failed to meet the burden to demonstrate inherency. M.P.E.P. § 2112 states:

[i]n relying on the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art . . . [t]o establish inherency, the extrinsic evidence “must make clear that the missing descriptive element matter is present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.

Here, the Examiner fails to present evidence, or sufficient factual basis to demonstrate inherency. The Examiner has merely provided a conclusory statement while failing to provide evidentiary support that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. Accordingly, Sato fails to teach or suggest at least the element “heating said silicon oxide left in said device isolation trench to remove impurities for densification,” as recited in claim 1.

Moreover, claim 1 recites a method comprising a sequence of steps including “vaporizing a solvent from said coat and then subjecting said coat to chemical treatment,” then “removing said film of the silicon oxide leaving a residue inside said device,” and finally “heating said silicon oxide left in said device isolation trench to remove impurities for densification.” Sato, whether taken alone or in combination, fails to teach or suggest at least this sequence of steps.

Sato teaches “etching ... the semiconductor substrate in order to ... remove the insulating films 2 and 3.” Sato, paragraph [0057]. As discussed above, however, Sato fails to teach the step “heating said silicon oxide left in said device isolation trench to

remove impurities for densification.” Moreover, the Examiner expressly states “Sato et al. fails to teach the steps of vaporizing a solvent from said coat and subjecting said coat to chemical reaction.” Office Action, page 3. Accordingly, Sato fails to teach or suggest at least the sequence of steps including “vaporizing a solvent from said coat and then subjecting said coat to chemical treatment,” then “removing said film of the silicon oxide leaving a residue inside said device,” and finally “heating said silicon oxide left in said device isolation trench to remove impurities for densification,” as recited in claim 1.

AAPA teaches a method comprising a sequence of steps including “modifying the coat into a silicon oxide through chemical reaction,” then “performing densification,” and finally “removing undesired portions to bury the silicon oxide in the trenches.” Applicants’ specification, page 1, lines 30-32. Accordingly, the Examiner’s proposed combination of Sato and AAPA would result in a method wherein “heating said silicon oxide for densification” would be performed **prior** to “removing said film of the silicon oxide leaving a residue inside said device isolation trench.” The combination of references thus fail to teach or suggest at least the sequence of steps including “vaporizing a solvent from said coat and then subjecting said coat to chemical treatment,” *then* “removing said film of the silicon oxide leaving a residue inside said device,” *and finally* “heating said silicon oxide left in said device isolation trench to remove impurities for densification,” as recited in claim 1.

Moreover, since the proposed combination would teach or suggest “heating said silicon oxide for densification” prior to “removing said film of the silicon oxide leaving a residue inside said device isolation trench,” Applicants respectfully submit that the

proposed combination of references would produce a semiconductor device with undesirable characteristics, and accordingly, there is no motivation for combining the references in the manner that the Examiner is suggesting. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983). By performing the method using this order of steps, there will inevitably be shape deterioration in the device isolation trenches. Conversely, the method as claimed in Applicants' claim 1, performs the steps in a reverse order, allowing silicon oxide to be buried in the device isolation trench without any adverse shape deterioration. Accordingly, since shape deterioration, which would result from AAPA, is undesirable, there is no motivation for combining the references in the manner the Examiner is suggesting. Since there is no motivation to combine the references, and the references fail to teach or suggest each and every element of the claim, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of claim 1 under 35 U.S.C. § 103(a) be withdrawn.

B. Sato in view of AAPA and further in view of Ahn

Claims 2-4 depend from claim 1 and thus require all of the elements of claim 1. Since Sato in view of AAPA fails to teach or suggest each and every element of claim 1, as discussed above, that combination of references also fails to teach all of the elements required by claims 2-4. Ahn fails to cure the deficiencies of Sato and AAPA.

Ahn is cited by the Examiner for allegedly teaching:

that is well known in the art to further include a silicon oxide film (109) over the surface of the etching resistive mask containing silicon nitride (103) (see fig. 6) after the formation of the device isolation trench (121) (see figs. 5-6), before forming the coat of [polysilazane] solution (119) (see fig. 6 and col. 4, lines 20-27 and 32-35), and after etching said silicon nitride (103) to etch back opening edges.

Office Action, page 4.

However, even assuming this statement is correct, Ahn fails to teach or suggest at least the sequence of steps including “vaporizing a solvent from said coat and then subjecting said coat to chemical treatment,” then “removing said film of the silicon oxide leaving a residue inside said device,” and finally “heating said silicon oxide left in said device isolation trench to remove impurities for densification,” as recited in claim 1, and required by claims 2-4. Since the references, whether taken alone or in combination, fail to teach each and every element of the claims, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of claims 2-4 under 35 U.S.C. § 103(a) be withdrawn.

C. Sato in view of AAPA, and further in view of Koyanagi

Claim 5 depends from claim 1 and thus requires all of the elements of claim 1. Since Sato in view of AAPA fails to teach or suggest each and every element of claim 1, as discussed above, that combination of references also fails to teach all of the elements required by claim 5.

Koyanagi is cited by the Examiner for allegedly teaching “that it is well known in the art to remove silicon oxide by CMP.” Office Action, page 5. Koyanagi fails to cure the deficiencies of Sato and AAPA, because Koyanagi also fails to teach or suggest at least the sequence of steps including “vaporizing a solvent from said coat and then

subjecting said coat to chemical treatment,” then “removing said film of the silicon oxide leaving a residue inside said device,” and finally “heating said silicon oxide left in said device isolation trench to remove impurities for densification,” as recited in claim 1.

Koyanagi, at Fig. 5 S3, teaches heating the substrate having an SiO₂ film to further densify the film. Koyanagi, col. 8, lines 54-59. Subsequently, the SiO₂ film is polished using CMP until only a residue is left in the trench. *Id.* at col. 8, lines 61-65. As explained in Fig. 15, and in Applicants’ specification at, for example, page 3, lines 3-25, this order of processes will inevitably cause shape deterioration in device isolation trenches. Conversely, Applicants’ claim 1 performs the processes in a reverse order to avoid any shape deterioration in device isolation trenches. Since the references fail to teach or suggest each and every element of the claim, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of claim 5 under 35 U.S.C. § 103(a) be withdrawn.

In view of the foregoing remarks, Applicants submit that this claimed invention is neither anticipated nor rendered obvious in view of the prior art references cited against this application. Applicants therefore request the withdrawal of the Final Office Action and the Examiner’s reconsideration and reexamination of the application, and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: June 16, 2005

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